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Senior High School

CURRICULUM GUIDE

Vocational Series

AUTO BODY 12-22-32

(Interim Edition, September 1964)

Province of Alberta

Department of Education

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COURSE CREDIT VALUES

Auto Body 12	5 credits
Auto Body 22	15 credits
Auto Body 32	15 or 20 credits

One credit corresponds to a minimum of 40 minutes of instruction time per week.

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FOREWORD

No single item of family or business property can compete with the automobile for the place it holds in our daily lives. Not only is it the accepted mode of transportation for business and pleasure but it provides the means of livelihood for millions of people.

Statistics show that one-seventh of the total labor force in the United States is employed either directly or indirectly in the automotive industry.

In the year 1950, Alberta had 151,724 cars registered. By 1961 this figure had reached 507,951. By 1970, the figure for 1961 is expected to be doubled. It should be noted also that these figures do not include commercial vehicles.

Body and fender men have been in demand ever since the automobile appeared. Now, with congested traffic, modern automobile design and high speed operation, there is an increasing need for the trained collision repairman. He is the one person who can restore to operating and presentable shape, the thousands of cars that are certain to be damaged each year in Canada.

This curriculum guide has been prepared for use in those high schools that have been approved by the Department of Education as possessing the facilities, equipment and qualified staff necessary to teach the program successfully.

The content of the three year sequence approximates the first two years of the Alberta Apprenticeship Program for Auto Body Mechanics. If the graduates of this program are to receive recognition for their work in high school, it is imperative that instruction be such as to ensure thorough coverage in training and understanding of the program outlined in the following pages.

OBJECTIVES

The general objectives of this program are:

(1) To equip a student with sufficient skill and knowledge such that he will be highly employable in the automotive industry.

(2) To enable the student entering the Auto Body Apprenticeship program, to advance at an accelerated rate on the basis of his proven ability on the job.

(3) To encourage the student in the development of desirable work habits, a sense of responsibility and the ability to cooperate with his associates.

(4) To develop an attitude of safety consciousness in the student, regarding all phases of the automotive industry.

GENERAL INFORMATION

1. Time Allocation

It is recommended that in the Auto Body 12, 22 and 32 courses, approximately one-third of the time be given to theory, and two-thirds to shop practice.

2. Safety Program

Every shop must have an effective safety program. In the automotive shop, particular attention must be given to incorporating the safety measures used in industry: running motors must be exhausted; dust and lacquer spray exhausted, machines adequately guarded; cleanliness of shop and personnel maintained at a high standard; students properly clothed for their work, etc. Shop organization must be well developed in order to ensure a stress on this important phase of the shop program.

A good safety program features the following: regular, consistent and thorough instruction; constant vigilance and checking by the instructor; safety posters; student safety committee, adequate first aid equipment; instructor trained and up-to-date in first aid methods; dynamic color painting of machines and equipment; adequate working space about machines; safety lines on floor around machines; routine report on accidents however minor; machines and tools in approved working condition; a safety conscious group of students and instructor.

3. Instructor's Records

The instructor should keep accurate records of:

(1) Student enrolment and attendance

(2) Customer and student accounts

(3) Student work activity

(4) Theory covered

(5) Tests given

(6) Student achievement, aptitudes and attitudes

(7) Up-to-date inventory of all equipment

4. Student Records

Instructors should ensure that the student develops and maintains a neat accurate record of:

(1) Notes on theory

(2) Daily shop activities (time cards)

5. Enrolment

It is recommended that the maximum enrolment should not exceed 16 students for any laboratory or shop class; however, two classes may be combined for the presentation of theory.

6. Guidance and Vocational Information

Instructors must assume responsibility in their own trade area to ensure that students and guidance officials are aware of the local situation with respect to that area. Instructors, through the Principal, have some responsibility for student placement. It is advisable that instructors be active, interested and informed.

NOTE: In order to permit students from an academic Grade X program to cross over into the vocational program at the Grade XI level, schools may combine the "12" and "22" course content into one course for a total of 20 credits. Students will be registered in the "12" and the "22" courses for 5 and 15 credits respectively. When these courses are combined, it is recommended that the students purchase the Grade XI text only.

INSTRUCTIONS ON THE USE OF THE FOLLOWING GUIDE

The course outline is divided into three columns designated: Work Activities, Basic Information and References. The first column outlines the type of activity performed by the students in the shop. The second column refers to the essential knowledge upon which a well educated employee in the automotive industry will depend, to adequately carry out the mutual activities outlined in the first column. The third column lists references pertaining to the Work Activity or the source of information. Instructors are requested to insert the references which they consider most suitable for the particular topics outlined. It would also be desirable if instructors noted the actual time devoted to the various units. This information will be extremely valuable to the curriculum sub-committee in revising this outline.

The authorized text for Auto Body 22 is "Automotive Collision Work" by Venk, Bedell and Spicer, General Publishing Co. Ltd. The authorized text for Auto Body 32 is "Automobile Sheet Metal Repair", by Sargent, published by Chilton Books and distributed by Ambassador Books Ltd.

NOTE: The Auto Body 12 course at the Grade X level is considered to be exploratory in nature. The knowledge and experience gained should enable the student to make an informed decision in regard to his possible future in this field.

AUTOBODY 12

5 credits (133 hours)

Suggested times are only for the guidance of the instructor.

Unit I - 12 hours
Unit II - 8 hours
Unit III - 35 hours
Unit IV - 35 hours
Unit V - 8 hours
Unit VI - 35 hours

UNIT I

Work Activities	Basic Information	Reference
1. Introduction	a. Nature of work b. Training necessary c. Earnings - flat rate - contract - hourly d. Working conditions e. Related occupations f. Advantages and disadvantages g. Future of the trade	
2. Shop Familiarization - tour of the shop - shop organization and procedures	Auto body tools - types and uses of the following: hammers, dollies, spoons, files and holders, caulking irons, pry bars, upholstery tools, special tools, Mechanics tools - Pliers . and side cutters, wrenches, sizes and types, screw drivers, sizes and types, metal cutters (chisels) punches. Auto Body Equipment - Air compressors, welding equipment, body jacks and attachments, disc sander, oscillating sander, belt sander, spray painting equipment, the spray booth exhaust fan, fire extinguishers, clean up equipment.	

Work Activities	Basic Information	Reference
3. Cutting metal using a hacksaw	Types and sizes of frames Length and types of blades Teeth per inch in relation to metal thickness Strokes per minute, tension on blade Posture and causes of blade breakage	
4. Drilling a hole using drill dress and electric hand drill	Cutting angle of drill bits Types of steel used How to sharpen a drill bit Avoiding breakage Need for centre punching Types, features, sizes, advantages, disadvantages, and safe operation	
5. Using a Grinder	Mounting wheels Adjusting tool rest Truing stones Safe use	
6. Sharpening chisels, reconditioning screw drivers, centre punches, pick hammers	Conditioning mushroom end	
Using a hammer	Types and proper use of hammers Installing handles	
7. Fastening a bolt and nut	Trade specifications and thread terminology Correct and safe usage of wrenches Selecting wrench type and size	
	Shop Procedure - Tool boards, Equipment cupboards, floor care Safety - welding and sanding masks spray painting masks exhaust fans	
8. Extinguishing a fire	Fire extinguishers - location and operation - types of fires - fire prevention	

Work Activities	Basic Information	Reference
9. A study of the construction of the automobile body and the variation in designs	Auto body parts - cowl, roof, floor, seats, door posts, doors, quarter panels, trunk and deck lid, floor pan.	
	The safety factors built into the all steel body - pillars, roof, safety glass.	
	Dust and Draft problems	
	Appearance consciousness on the part of the public	
	External - paint, trim mouldings and ornaments	
	Internal - upholstery, trim panels, interior mouldings and handles	
	The hood and grille - Engine cover, ventilation of radiator and engine, vision problems for the driver	
	The fenders - The wheel covers, dust and mud protectors, problems of reck and rust damage integral body and fender designs	
	Body bolted to frame and integral with frame History of auto body construction and design Wood framework, exposed radiators, separate fenders, plate glass, heavy metal hard to repair, the arc welding process and its impact on auto body construction.	
	Metals used in automobile construction. Ferrous metals cast iron for engine blocks, gear cases, steel for body metal must be of soft and ductile frames and bumpers must be tough;gears, must be hard non-ferrous - aluminum for mouldings, engine parts step plates - copper for radiators, tubing, wiring. Lead for batteries, solder. White metal for ornaments, grilles, stainless steel for mouldings and grilles.	

Work Activities	Basic Information	Reference
	Use of plastics for interior parts on the increase. Future may see more of it used on exterior parts.	
	The formation of body panels - hydraulic presses, dies, made from flat stock.	
	Strength of body metal. Sculptured metal and repair problems.	
	Auto body damage caused by rust, collision upset, metal fatigue concerned with the functional - doors to fit, hood, grille and fenders in alignment concerned with appearance smooth finish, mouldings in alignment, paint smooth and dust free.	
	UNIT II (Alignment)	
1. A study of auto body damage as caused by upset.	Direct damage to roof, upper door openings, door posts, glass, hood and fenders.	
	Indirect damage - spilling of oil, battery acid, fuel.	
	Damage to mechanical parts, bent wheels, frames, twisted steering parts, bent.	
2. A study of auto body damage as caused by front end collision.	Direct damage to grille, bumper hood, fenders and inner construction.	
	Indirect damage to steering, buckled and diamond frames, floor pan, engine and transmission.	
3. A study of rear end damage caused by collision.	Direct damage to bumper trunk lid, rear fenders.	
	Indirect damage to frame.	

Work Activities	Basic Information	Reference
4. A study of auto body damage as caused by side swiping or collision.	Direct damage to front and rear fenders, doors and door post rocker panel. Indirect damage to frame.	
5. Analyzing auto body damage.	Reconstructing the order in which the damage occurred. Severe damage, frame must be checked first and repaired before attempting any body repairs. Use of trammel and levelling gauges. Inner construction must be repaired before the outer construction. Checking door openings, fit and contours with undamaged or other similar models.	
6. Alignment Procedures.	Selection of tools, hydraulic equipment for pulling and pushing, checking with trammel, tape measure between corresponding points. Points to anchor jacks, spreading the pressure over large areas. Care not to create additional damage. Allowance for spring back by going beyond original dimensions. Relieving damaged metal, unlocking the metal. Proceed from large to small areas, work in the reverse to the damage. Constant checking necessary. Holding sections while pushing or pulling others.	
7. Simple alignment Tasks.		
- Hood and trunk alignment, using shims.	Hood and trunk extension of body setting hinges. Location of shims.	
- Head Lite focusing.	Setting head lites.	
- Steering clearances.	Points to check.	

Work Activities	Basic Information	Reference
- Aligning bumpers.	Using porto power installing shims, eccentric bolts, alignment of brackets.	
- Front doors to fenders.	Using porto power location of bolts, using shims.	
- Sagging front doors.	Doors can be moved up and down, in or out by loosening hinge bolts. Body may require shimming at frame. Doors must be checked with car sitting level.	
- Setting door stricker plates, trunk and hood locks.	Lock to hit stricker squarely, lubricate moving parts, check to see that rubber grommets are in place. Adjustments cannot be made unless alignment is correct.	

UNIT III

(Metal Finishing)

1. Roughing out, bumping and picking.	First operation is planning the repair - work from outside in towards centre of damage. Little or no outer ridging; pressure applied manually or light jacking.	
- Massive areas 2 - 3 feet in diameter, roof, lower door panels.		
- Large areas up to 2 feet in diameter.	Presence of outer ridging, stretched metal and potential high spots, use of jacks, spoons, bumping hammers.	
- Small areas up to 8 inches in diameter.	Use of dolly in bumping, dinging with hammer and dolly, spooning high spots.	
- Spot areas, picking up low spots.	Use of the sharp pointed hammer; care in not overworking the metal reason for picking, used with the body file.	

Work Activities	Basic Information	Reference
2. Body Filing		
- Construction of the flat body file.	Types of holders, installation of the blade, care of the file, difference from other files, lathe cut, a fine cutting tool, used as a guide rather than a tool for removing metal, used with picking hammer.	
- Proper use of the file.	Light pressure, complete stroke, angle and direction of blade to work dinging and spooning high spots, picking low spots.	
- Checking file work	Cross filing - 45°, 90°, by feel, gloved hand best.	
3. The Disc Sander	Sizes and voltage necessity for grounding.	
- Removal and replacement of discs.	Types of discs open and closed coats. Various grits for specific purposes. Selection of discs.	
Handling the Sander	Angle of disc and contact area. Used for paint removal preliminary to filing, cleaning metal of rust, weld scale, preliminary removal of excess solder or cold fillers. Limitations - will not replace the body file for shaping metal, not a guide for metal finishing.	
4. Simple Metal Finishing. Tasks on junked body parts to include roughing out, bumping, dinging, filing, sanding, picking and checking.	Stress and tension to be maintained in body panels; overworking causes thin spots, diaphraming, metal fatigue.	

UNIT IV

(Auto Body Welding)

Work Activities	Basic Information	Reference
1. Discussion	History of oxy-acetylene welding	
2. Safe handling and storing of oxygen cylinders.	- Capacity in cubic feet - Pressure - Sizes of cylinders - Oxygen and oil an explosive combination - Construction and operation of tank valve - Importance of proper storing and handling	
3. Handling and Storing Acetylene Cylinders	- Cylinder filling - Purpose of acetone content - Safety plugs - Construction and operation of valves. - Capacity in cubic feet - Sold by weight - Importance of proper storing and handling.	
4. Pressure Gauges and Regulations - Pre set - Single stage - Two stage	Gauges register tank content and working pressure regulators convert high pressure to working pressure acetylene red not to be used on oxygen or as air regulator oxygen; green not to be used for any other purpose; keep away from oil, do not lubricate with oil.	
5. Hoses	Oxygen green R. H. thread acetylene red L. H. thread. Necessity for having connections and hose in good working order.	
6. The Welding Torch	Features of L. P., H. P., and E. P. torches. Tips and mixers to be suited to each other. Uses of the cutting attachment and operation. Air burning tips. Care and cleaning of tips.	

Work Activities	Basic Information	Reference
7. Setting up Equipment	Need for mobility	
- Position and securing cylinders	Reasons for	
- Cracking cylinder valves	Reasons for	
- Attaching Regulators		
- Connecting hoses to regulators	Blowing out hoses	
- Connecting torch handle to hoses		
- Attaching welding tip to handle		
- Opening cylinder valves	- Slowly at first; oxygen wide open acetylene $1\frac{1}{2}$ turns; leave valve handle in place testing for leaks.	
- Adjusting working pressure		
8. Lighting the Torch	Use striker only	
- Setting working pressure to correct velocity for tip size.	Gas pressure in relation to tip size.	
- Adjusting flame	Three kinds of flame	
	Temperature of flame	
	Flashbacks and backfire	
	Care and use of protective equipment	

Work Activities	Basic Information	Reference
9. Shutting down the Equipment.	Sequence to follow in extinguishing flame.	
- Turning off torch.		
- Releasing line pressure.	Danger in releasing free acetylene, sequence to follow.	
- Closing tank valves.		
- Storing equipment.	Hoses in place.	
	Portable cart stored in safe area.	
10. Use of oxy-acetylene Equipment in Auto Body.		
- Welding of cracked metal, panel replacement cutting, reinforcing.	Danger of fire - Precautions necessary.	
- Heating for purposes of straightening, forging, shrinking.	Care not to over heat, changes grain structure and properties of metal.	
- Applying hot fillers.	Type of tip and flame.	
11. Simple Welding Tasks - Preparing job and equipment.	Dressing in preparation for welding, gloves, goggles, other clothes.	
	Identification of metals. Necessity of cleaning metals. Selection if Tip.	
Running a bead without filler rod on 16 gauge M.S.	Size of tip. Type of flame. Torch movement. Distance of central cone from work. Puddle formation. Speed of travel. Angle of tip. Inclination with work. Appearance of finished bead.	
Inspecting weld.	Causes of faults.	

Work Activities	Basic Information	Reference
Running a bead with filler rod on 16 GA	- Size of bead. - Position of filler rod. - Effect of different flame settings.	
Welding sheet metal	- Spacing and tack welding. - Appearance of weld.	
- Butt weld on coupons cut from auto sheet metal.	- Method of obtaining penetration. - Obtaining proper fusion.	
- Lap welding on coupons cut from auto sheet metal.	- Preparation. - Torch position and angle. - Rod position.	
- Brazing - Mild Steel.	- Definition of brazing. - Characteristics and properties of filler metal. - Preparation of base metal. - Flame setting. - Tinning. - Advantages and limitations.	
- Cutting with the oxy-acetylene torch.	- Uses in auto body. - Precautions necessary. - Tip sizes. - Method of adjustment. - Angle of torch and distance of flame from work. - Meaning of kerf. - Cutting holes.	

U N I T V

Work Activities	Basic Information	Reference
Functions of interior Finishing		
- Sealing	Draft and dust; weatherstrip, windale, methods of installation clipped, nailed, glued.	
- Noise and Vibration	Carpeting, deadening,material, fibre glass insulation, panel boards and coverings.	
- Concealing	Locking and window mechanism. Interior body construction welding and bracing.	
- Comfort	Seat construction. Upholstery. Arrangement of controls and hardware.	
- Appearance	Buyer Appeal. Need for cleanliness.	
- Seat construction and upholstery	Spring and frame construction. Padding, felt and foam.	
- Door Inner Panels	Hardboard foundation. Application of coverings. Methods of installation.	
- Interior Hardware	Garnish mouldings. Window regulators and door handles, methods of installation.	
- Door trunk and hood hinges	Exterior and interior hinges. Provisions for adjustment. Counter balanced trunks and hoods. Locking devices and adjustments.	

Work Activities	Basic Information	Reference
Introduction to Auto body Painting	Lacquers, quick drying. Enamels, baked finishes, air dry finishes, high initial gloss. Thinners and reducers. Precautions necessary.	
Problems related to Surface	Unlike wood surface. Gloss magnifies surface. Imperfections.	
Problems related to Adhesion	No penetration of undercoats. Adhesion to "Tooth" of bare metal or old surfaces. Effects of dust, oil, grease, wax.	
Surface Preparation and Sanding of:		
1. Bare Metal	Use of metal prep. Final sanding with #50 grit or finer. Necessity of priming.	
2. Old Paint Surface	Check for Adhesion. Feather edgeing. Use of Cleaners. Glazing; scratches, chips.	
3. Masking	Exactness, masking to line. Tape, ease of removal. Masked - not painted. Unmasked - will be paintdd. Use of Newspaper. Advantage of masker. Limited use of compounds. Plastic cover for large areas.	
Spraying Equipment		
- Regulator and Gauges	Purpose of regulator and gauges.	
- Air Hose and Fittings	Size of hose. Quick couplers for speedy removal.	

Work Activities	Basic Information	Reference
Air Compressors	Various Sizes. Need for large capacity. Need for servicing and cleanliness. Need for air line trap and filter.	
Spray gun cleaning, take down and assembly	Syphon feedtype. Pressurized container. Spray gun parts. Regulating valves for air and paint.	
Paint and Primer Spraying	Viscosity of material. Effect of Temperature. Function of thinners and reducers. Spraying technique. Spray patterns. Common faults, orange peel, runs, blushing of lacquer.	

AUTOBODY 22

Whereas Autobody 12 is an exploratory course open to all Grade X students, Autobody 22 and 32 are definitely vocational and only those students who have displayed ability and aptitude for the program should be encouraged to continue. It is not in the best interests of the student to permit him to continue in a program which demands a large portion of his school time and in which the instructor and/or the guidance counsellor feel that he has little chance of success.

TEXT: Automotive Collision Work - Frazee, Bedell, Spicer.

UNIT 1

(Introduction)

Work Activities	Basic Information	References
1. Shop tour.	1. Course introduction.	
	2. Shop rules and regulations.	
2. Examination of shop equipment with an outline of the proper operating procedures for safe efficient workmanship.	3. Safety.	W. C. B. Posters Lectures and films from local fire departments.
	4. Job opportunities and requirements.	Apprenticeship Board. Alberta Institute requirements.
3. Design and criticize different shop arrangements.	5. Shop layout	Toboldt Wait
4. Examine and complete different work orders and estimates.	6. Business fundamentals: a. Estimating b. Flat rate schedules c. Repairable and replacement parts. d. Simple cost accounting.	Wait Packer Sample Work orders and estimates from local retail outlets. Motors Flat Rate Manual.
5. Practice in shop periods different methods used in industry for tool, supply and work control.		

UNIT II

(Language and Tools of Autobody)

Work Activities	Basic Information	References
1. Practice in the care and selection of mechanical hand tools for different types of damage:	1. Detailed use of mechanical hand tools.	
a. Care and use of low crown, high crown and roughing dollies.		
b. Construction care and use of the body file on concave, convex and flat surfaces.		Automotive manuals
		Frazee
c. Types and care of bumping hammers and where used.		Wait
d. The care and use of pick hammers.		Toboldt
		Chilton's
e. The use of the slide hammer and attachments in closed panel repairs.	2. Autobody and frametypes and construction with detailed nomenclature.	
f. Care and use of body spoons.		
g. Tools used in repair of fender flanges, fender and drip moulds.		
h. Special hand and power tools		
2. Work on shop model autobody units to familiarize student with nomenclature and types of body and frame construction:		
a. Remove and replace doors and adjust latches.		

Work Activities	Basic Information	References
b. Remove and replace windows and regulators.		
c. Remove and replace trunk lid and hinges and adjust.	3. Autobody metals and metal alloys and the types of design for maximum strength.	
d. Remove and replace hood and adjust.		
e. Remove and replace bumpers and bumper arms.		
f. Remove and replace fender assembly.		
g. Remove and replace grille.		
h. Remove and replace radiator support and fender aprons.	4. Autobody accessory parts - construction and function:	
i. Remove and replace body.	a. Gravel guards b. Bumpers	
j. With body removed, inspect frame: (a) Type (b) Parts	c. Grilles d. Fender aprons e. Splash pans f. Brackets and braces	
	5. Detailed study of sizes and functions of all types of screws and fasteners used in autobody construction.	

UNIT III

(Alignment)

Work Activities	Basic Information	References
1. Work activities should be simulated on shop models with a minimum of live work:		
a. Practice in light jacking on roof or door panel on areas two to three feet in diameter with little or no outer ridging.	1. The body jack-parts, uses and the proper care and maintenance.	
b. Practice jacking on areas up to two feet in diameter with outer ridging.		
c. Fit headlights in damaged fenders and align.	2. Principles of measurement to properly analyze minor body and frame damage.	Frazee
d. Correct fender alignment for steering clearances.		Wait
e. Straighten and align bent bumper brackets so that face bar aligns with the fenders.	3. Principles of body shell alignment: a. Roof b. Pillars c. Doors d. Window openings	Teboldt Chilton's Packer
f. Straighten door hinges and align front doors.		
	4. Determine minor frame damage by checking and repairing bumper damage.	
	5. Major causes of fender to body misalignment.	

UNIT IV

(Metal Finishing)

Work Activities	Basic Information	References
1. Demonstrations and practice on shop models:		
a. Practice in the use of the dolly roughing large areas with little or no ridging.		
b. Practice in the use of the dolly in large areas with outer ridging.	1. Assessing body damage and determining correct procedure for restoring the metal to its original form.	
c. Practice in the use of low crown and high crown dollies.		
d. Practice in pick hammering.	2. Review of bumping, forging, dinging, picking and filing procedures.	Frazee
e. Practice in direct hammering.		Wait
f. Practice in indirect hammering.	3. Low and high crown metal finishing.	Toboldt
g. Practice in the use of the surface spoon.	4. Construction, operation, function and maintenance of the Sanding Disc.	Packer Chilton's
h. Practice in filing low crown, high crown and flat areas.		
i. Practice in the use of the sanding disc.		
j. Practice in shrinking metal.		
k. Practice in sinking wells.		

UNIT V

(Autobody Welding)

Work Activities	Basic Information	References
Shop practice should be on metal 1/4 " thick or less. Students should practice the following type welds:	1. Review of the proper procedures for the care and set up of acetylene and arc welding equipment.	
1. Adjust clearance and perform fusion butt welds, in the flat, horizontal and vertical positions.		
2. Practice in the construction of lap welds in the flat, horizontal and vertical positions.	2. Review of the safety rules in welding.	
3. Practice in the construction of corner beads in the horizontal and vertical positions.	3. An introduction to basic metallurgy and the effect of different temperatures and flame types on welds.	
4. Practice in the construction of bronze butt welds in the flat, horizontal and vertical positions.	4. Types of rods used in fusion, arc and braze welding with the composition and function of fluxes.	Frazee Chilton's Packer The Oxy-Acetylene Handbook (Linde) Theory and Practice of Arc Welding (Sacks)
5. Practice in the construction of arc butt welds in the flat, horizontal and vertical positions.	5. The theory and methods of distortion control.	
6. Practice in the construction of spot welds to control distortion.		
7. Demonstration in the following: a. Overhead welding b. Aluminum welding c. Aluminum brazing		

UNIT VI

(Autobody Painting)

Work Activities	Basic Information	References
Shop practice should be performed on doors and closed panels on shop models or parts.		
1. Refinish damage with hot fillers.	1. Composition, uses and application procedures for the different types of undercoats.	
2. Refinish damage with cold fillers.	2. Review of the composition and proper finishing procedures for hot fillers.	
3. Perform final checks for painting. 4. Spray and sand undercoating.	3. Composition, uses, application and finishing procedures for the different types of cold fillers.	Toboldt Chilton's Packer
5. Practice spraying with enamel.	4. Composition, uses and spraying techniques for lacquers, enamels and acrylic type paints.	

UNIT VII

(Interior Body Trim and Hardware)

Shop practice in this unit may be done on shop models or automobiles brought in for appearance reconditioning.	Types and function of interior finishing:	
1. Cleaning upholstery.	a. Sealing - draft and dust - water	
	b. Noise and vibration dampners - carpeting - fire wall padding - kick boards and covering	

Work Activities	Basic Information	References
2. Remove and replace garnish mouldings. 3. Remove and replace interior emblems.	c. Concealing - locking and window mechanisms - interior body construction - welding and bracing	
4. Remove, repair and replace headliners.		Automotive Manuals
5. Remove, recondition and replace door panel trim pads. 6. Make up and install kick pads.	d. Comfort - seat construction - upholstery - arrangement of controls and hardware	
7. Make up and install trunk liners.		

REFERENCES

1. Automotive Collision Work - Venk Bedell Spicer

2. Automotive Body and Fender Repairs - C. E. Packer

3. Collision Work Study Guide - Frazee

4. Panel Beading and Body Repairing - Donald Wait

5. Automobile Sheet Metal Repair - Robert L. Sargent

6. Automobile Body Reconditioning - T. Wohlfeil and others

7. Toboldt's Automotive Repair and Refinishing

8. The Oxy-Acetylene Handbook - Linde

9. Theory and Practice of Arc Welding - Raymond J. Sacks

AUTOBODY 32

Text - "Automobile Sheet Metal Repair" by Sargent, published by Chilton Books and distributed by Ambassador Books Ltd.

UNIT I

INTRODUCTION

(Suggested Time - 35 hours)

Work Activities	Basic Information	References
1. Decisions on Repairable and Replaceable Parts		
a. Comparing cost of replacement to cost of repair.	Necessary to consider related operations when replacing parts.	
2. Installation of New Parts.	Need for correct alignment of sub-structures.	
3. Auto Body Business Fundamentals, Estimating, Flat Rate Schedules.	Need for considering unforseen damage to sub-structures.	Flat Rate Manuals.
	Painting a separate operation from the metal repair.	Manufacturers' Manuals.
	Need for including miscellaneous materials.	

UNIT II

ALIGNMENT

(Suggested Time - 60 hours)

Work Activities	Basic Information	References
1. Front End Alignment Hood, Grille, Front Fenders.	Frame Alignment is of prime importance.	
a. Practice in aligning hood openings.	Use and placing of jacking and pulling equipment.	Black Hawk Manufacturing Co.
b. Practice in aligning front fenders.	Cross checking to determine alignment problem.	
c. Checking and correcting front door to fender spacing.	Relocating bolt holes to correct alignment. Use of shims to correct alignment.	

Work Activities	Basic Information	References
d. Removing, replacing, servicing and adjustment of hood locks and hinges.	Purpose of slotted holes.	
e. Use of shims to correct alignment of hood and fenders.	Location of shims. Need for correct fit.	Manufacturers' Manuals.
2. Rear Body Alignment Trunk Compartment and Deck Ltd.		
a. Practice in the service location of shims, and setting of trunk.hinges and trunk locks. Need for correct fit.		
3. Theory of Major Frame Alignment		
a. Demonstration of a frame check.	Method of checking wheel base and tracking to determine frame alignment. Types of frame damage and effect on body alignment. Methods of correcting frame damage.	Black Hawk Manufacturing Co.
4. Pulling with the Body Jack.		
a. Practice in setting up and using pulling equipment.	Danger of creating extra damage and necessity for reinforcing weak areas. Direction of pulling force. Selection of anchor points. Relieving stressed metal by spooning or heating.	Black Hawk Manufacturing Co.

UNIT III

METAL FINISHING

(Suggested Time - 100 hours)

Work Activities	Basic Information	References
. Practice in all Phases of Auto Body Repair	Assessing types of body damage.	
a. Practice in the use of pushing and pulling equipment.	Determining the selection of equipment. Keeping metal under tension during repair. Determining repair procedure.	
b. Practice in the use of pry bars, dollies, hammers.	Necessity for care in not creating extra damage.	
c. Practice in the use of the body file and sanders.	Correct use of body file and sander.	
d. Practice in shrinking stretched metal.	Danger of collapsing low crowned surfaces. Danger of bulge creep. (False stretch)	
e. Practice in repairing closed areas.	Use of fillers. Use of pry bars. Opening closed areas.	
2. Proper Use of Fillers		
a. Practice in the selection and application of cold and hot fillers in all positions.	Need for correct preparation. Methods of application. Pros and cons of both hot and cold fillers.	

UNIT IV

AUTO BODY WELDING

(Suggested Time - 60 hours)

Work Activities	Basic Information	References
Review safety practices for welding		The Oxy-Acetylene Handbook. Film strips, Kit A--Oxy-Acetylene Welding, Jam Handy Organization.
Review first nine work activities in Auto Body welding 12		

Work Activities	Basic Information	References
1. Improvement in Auto Body Welding. Identification and weldability of all metals used in the auto trade.	Review of basic metallurgy. Chemical and physical properties of metals. Hot and cold short.	Robert L. Sargent. Donald Wait.
2. Practice in the construction construction of fusion butt welds, with and without the use of a filler rod on 20, 18, 16 gauge, and 1/8 " mild steel in all positions.	Advantages, and disadvantages of using filler rod. Distortion control.	Donald Wait.
3. Practice in the construction of fusion lap welds using a filler rod on 20 gauge mild steel. Welding in all positions.	Where and when to use lap welds. Disadvantages due to risidual stresses and distortion.	Donald Wait.
4. Practice in the use of solder fill on live work.	When to use solder fill. Physical and chemical properties of solder used. Methods of cleaning and tinning the metal. Methods of application. Common faults in as applied to solder fill.	Robert L. Sargent.
5. Practice in fitting and welding in place of replacement panels.		
a. Ordering the panels.	Vehicle and panel identification. Use of slip-on type panels.	
b. Removing the trim and hardware.	Fire hazards and possible damage to trim.	
c. Locating the panel joints.	Joint fill removal. Necessity of removing tin from the surface of the steel. Method of drilling and breaking spot welds.	
d. Cutting the panel.	Advantages and disadvantages of using a saw, oxyacetylene, panel cutter, chisel, and tinner snips. Use of a disc sender to remove door panels.	

Work Activities	Basic Information	References
e. Installing the panels.	Need, and how to obtain alignment of panel. Types of clamping devices. Purpose and method of tack welds. Procedure of filling joints. Necessity of sealing the joints. Installation of trim and hardware.	
6. Practice in the use of a cutting torch.	Review of oxy-acetylene cutting - "12". Flame chemistry. Analysis of the operation of cutting equipment. Danger of flashback due to unbalanced pressures. Common faults in cutting.	Oxy-acetylene Handbook (Linde)
a. Cleaning a cutting tip.		
b. Cleaning and care of cutting torch.		
7. Practice in brazing butt and lap joints on sheet metal (live work where possible)	Review brazing "22"., stress cleaning the metal. Joints are hot short.	Sargent
8. Demonstration of silver soldering.	Advantages of sliver soldering. Physical properties and construction of joint for maximum strength.	Donald Wait. Oxy-acetylene Handbook (Linde)
9. Demonstration in diecasting welding, aluminum welding and aluminum brazing.	Properties of aluminum and its alloys.	
10. Practice in the use of arc, and spot welder (use of A.C. and D.C. machines) making butt and lap welds. Use of 6010, 6011, 6012, 6013, and 6014 electrodes. Metal thickness, 20 gauge to 1/8".	N.B. effects of arc welding on vehicles fitted with alternators. Construction of arc welds. Physical properties of welds. Types of stress line flow. Reasons for weld failure.	Theory and practice of arc welding. (Sacks)

UNIT V

AUTO BODY PAINTING

(Suggested Time - 105 Hours)

Work Activities	Basic Information	References
1. Use and maintain the spary booth, equipment and heat lamps:	The use and construction of wet and dry spray booths.	A,B,C's of Spray Painting -DeVilbiss Co.
a. Practice in the preparation of the spray booth prior to painting.	Need for adequate heat and exhaust fans. Purpose of filters in spray booths. Use of protective coatings on spray booth surfaces. Need for proper reducers. Positioning of heat lamps. Hazards of static electricity and open flame. Correct room temperature. Importance of cleaning equipment for safety and for quality of work. Portable units. Care and maintenance of equipment.	
b. Practice in the installation and cleaning of heat lamps.		
c. Inspection and report on spray booth conditions. Check city by-laws with regard to ventilating and spraying of inflammable materials.		Du Bois Chemicals.
d. Cleaning and maintaining an exhaust fan.	Need for sealed electric motors. Purpose and location of exhaust fan. Capacity in relation to room size.	
e. Cleaning spray room filters.	Materials used in filters. Methods used to clean filters. Replacing filters.	
2. Review Spray Equipment "12".		Venk, Spicer and Davies. Toboldt. CIL Information
3. Review Painting "12". -Surface preparation and sanding.		
4. Improvement by practice spraying primer, using live work. Selection of primer surfacer.	Types of surfacers. Types of thinners (Quality). Purpose of surfacer. Viscosity. Purpose, and advantage of different coloured surfacers.	
a. Application of primer surfacer.	Air pressure. (line drop). Film thickness. Drying time. Techniques of application. Problems.	

Work Activities	Basic Information	References
b. Sanding surfacer.	Types and grades of sand paper. Care of, and methods of cleaning paper. Toothing.	3M CIL Information
c. Application of putty.	Methods of application. Pitfall to avoid.	
5. Theory of colour mixing, and control.	How to read a paint manual.	CIL Colour Information
6. Improvement by practice on live work spraying enamel finishes.	Methods of determining the correct viscosity. Filter the material. Spray gun techniques. Air pressure. Time between coats.	Venk, Spicer and Davies. Toboldt.
a. Applying metallic base colours.	Effects of air pressure. Spray techniques, Necessity of misty coat. Painting the whole car, or panel.	CIL Information.
b. Baking paint finishes with infra-red heat lamps.		
7. Paint problems and solutions.		CIL Information.

U N I T V I

AUTO BODY TRIM AND HARDWARE

(Suggested Time - 39 Hours)

Work Activities	Basic Information	References
1. Headlining removal and replacement (Demonstration)	Construction of headlinings. Need for removal, i.e., roof repairs, squeaks and rattles. Protection during storage. Protection during welding.	Toboldt.
2. Theory on electric windows,		
a. Practice in replacement and repair of door locks and window regulators. Practice in setting door locks and adjusting door hinges.	Types of door locks, construction, and safety devices. Types of window regulators, Squeaks and rattles in door hardware.	Toboldt.

Work Activities	Basic Information	References
3. Practice in glass replacement. (Windshield, back glass, door and vent glass.)	Types of door locks, construction, and safety devices. Types of window regulators. Squeaks and rattles in door hardware.	Venk, Spicer, Davies.
4. Practice in basic body wiring. Reconnecting head, park and tail lights. Using a test light.	How to read a wiring diagram. Care of wires during repairs. Need to disconnect, or remove battery during front end repair operation.	Workshop manuals. Toboldt.

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